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Publication date:
2005

Document Version
Publisher's PDF, also known as Version of record

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Citation (APA):

Juul Rasmussen, J., Bang, O., Krolikowski, W. Z., & Wyller, J. (2005). *Nonlinear wave dynamics in nonlocal media (Invited paper)*. Abstract from Mini symposium on new trends in nonlinear physics, International Center for Theoretical Physics (ICTP), Trieste (IT), 17 Sep.

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NONLINEAR WAVE DYNAMICS IN NONLOCAL MEDIA

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A review of the recent advances in the understanding of the propagation properties of waves in nonlinear media with a spatially nonlocal nonlinear response is presented [1]. We consider in particular the impact of nonlocality on the modulational instability of plane waves, the structural stability and collapse of finite-size wave beams, and the formation and interaction of spatial solitons.

The nonlocality modifies the stability of plane waves, depending on whether the spectrum of the nonlocal response function is positive definite or not. If the spectrum is positive definite nonlocality always tends to suppress MI, but can never eliminate it completely. If the spectrum is not positive definite nonlocality leads to the appearance of higher order instability bands for focusing media. For defocusing media the effect of nonlocality is even more dramatic, as it actually initiates instability of the plane waves.

The nonlocal nonlinearity also alters the interaction properties of solitons, as an example we discuss the interaction of dark solitons. The nonlocality is found to induce attraction of normally repelling dark solitons and allows for the formation of stable bound states.

In local cubic nonlinear media multi-dimensional beams are unstable and collapse if they have a power above a certain critical value. It is shown that a nonlocal nonlinearity always will arrest the collapse and allow for the formation of stable multi-dimensional solitons.

References

- [1] Królikowski, W., Bang, O., Nikolov, N.I., Neshev, D., Wyller, J., Rasmussen, J. Juul, and Edmundson, D., Modulational instability. Solitons and beam propagation in nonlocal nonlinear media, J. Optics B (2004) **6**, S288-294.